**3GPP TSG-RAN2 #116-e R2-210xxxx**

**Electronic meeting, November 1 – November 12, 2021**

**Agenda item:**8.6.2 (NR\_SmallData\_INACTIVE-Core)

**Source:** LG Electronics (Rapporteur)

**Title:** [AT116-e][503][SData] UP SDT open issues (LG)

**Document for:** Discussion and Decision

# 1. Introduction

This document summarizes issues identified in the documents submitted to A.I. 8.6.2 User plane common aspects.

Note that not all the issues submitted to A.I. 8.6.2 are summarized in this document. Issues overlapped with other e-mail discussions and issues not related to user plane are not covered.

Deadline for providing comments:

* + - Companies inputs – November 4, 23:59 UTC
		- Rapporteur summary – November 5
		- Final comments on Rapporteur summary – November 8, 23:59 UTC

# 2. Discussion

## 2.1 PDCP status report

The related proposals in the submitted documents are captured below.

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| [6] Proposal 2 When RRCResume is received in response to SDT or RRC resume procedure after SDT, RRC determines whether or not to (re-)enalbe PDCP status report based on the radio bear configuration included in RRCResume.[6] Proposal 3 If the statusReportRequired configuration for the corresponding SDT radio bearer is not updated in RRCResume, RRC re-configures the PDCP with statusReportRequired if it is deconfigurd for SDT.[6] Proposal 4 If the statusReportRequired configuration for the corresponding SDT radio bearer is updated in RRCResume, RRC is subject to the latest configuration to determine whether or not to enable PDCP status report.[7] Proposal 3: UE disables the statusReportRequired configuration autonomously when initiating the SDT procdure.[7] Proposal 4: The PDCP status reporting is enabled according to the NW explicitly configuration.[11] Proposal 3: PDCP status report during SDT initiation is disabled in PDCP instead of RRC.[15] Proposal 2: NW explicitly configures PDCP status reporting for SDT DRBs for which it has been disabled during SDT proceure.[19] Proposal 2: Agree on the text in RRC specification that “2> for each radio bearer that is configured for SDT: 3> re-establish PDCP entity for the radio bearer without triggering PDCP status report;”. |

In RAN2#115e meeting, it is agreed that at initiation of SDT procedure, the PDCP status report is not triggered even if the RB is configured with statusReportRequired. The remaining issue is whether the statusReportRquired is automatically enabled at the termination of SDT procedure or enabled by NW explicit signalling.

**Issue 1: If a RB is configured with statusReportRequired and if it is disabled at initiation of SDT procedure, how the statusReportReqruied is enabled?**

**- Option 1: The statusReportRequired is automatically enabled at termination of SDT procedure, i.e. PDCP status report is temporarily disabled during SDT procedure.**

**- Option 2: The statusReportRequired remains disabled until the network provides explicit signalling to enable it.**

**Q1: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 | This option is already implemented in the running CR and companies seem to be fine with this (?). From network perspective, this means that the UE context is same with or without SDT when the UE moves to the connected state. So, the connected state configuration is not impacted by whether or not SDT was used in the past and hence this is simpler solution (please check the implementation in the running CR and comment if any changes are needed).  |
| Sharp | Option 1 |  |
| OPPO | Option 1 and Option 2 | We think both UE autonomous re-enabling and signalling-based re-enabling are needed.If SDT is terminated by the reception of RRCResume, UE shall decide whether to re-enable the PDCP status report according to the radio bear config included in RRC message. For example,- if the configuration of SDT-RB is updated in RRC signalling, UE shall be subject to the latest configuration to determine whether or not to enable PDCP status report. - if there is no radio bearer config for SDT-RB provided, which means that UE shall use the one stored in UE context, UE needs to re-enable PDCP status report autonomously.For case that SDT is terminated by receiving RRCRelease, we do not think PDCP status reporting needs to be re-enabled. |

## 2.2 ROHC continuity

The related proposals in the submitted documents are captured below.

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| [1] Proposal 1: If drb-ContinueROHC has been provided and the RRC connection is resumed on the same cell where the connection was suspended, continue the header compression protocol context for the DRB(s) of PCell configured with the header compression protocol in NR-SDT.[2] Proposal 1: Discuss and agree one of the following options for ROHC continuityOption 1: If the drb-ContinueROHC is configured for DRB in the stored inactive AS context and if UE is in same cell since it last received drb-ContinueROHC configuration from network, RoHC context of that DRB is continued. Otherwise, not.Option 2: If the drb-ContinueROHC is configured for DRB in the stored inactive AS context and if UE is in same RAN notification area since it last received drb-ContinueROHC configuration from network, RoHC context of that DRB is continued. Otherwise, not.[8] Proposal 2: If ROHC continuity is configured for SDT, the UE applies ROHC in case SDT is triggered in the same RNA as the cell from which the UE received RRCRelease with suspend.[11] Proposal 2: the area scope of ROHC continuity specified in the specification is with the same serving cell in SDT.[12] Proposal 5: If ROHC continuity for SDT is configured in RRCRelease message, the UE shall assume that ROHC continuity can be applied to all cells within the RNA. |

In RAN2#115e meeting, it is agreed that the area scope of ROHC continuity is specified in the specification, i.e. gNB configuration is not needed. However, the area scope of the ROHC continuity is still not decided.

In the last meeting, slight majority companies support cell level ROHC continuity (15/33). But the same question is asked again to check if companies change their opinions. We may need to go for the option with absolute majority in this meeting.

**Issue 2: If ROHC continuity is configured, what is the area scope of ROHC continuity?**

**- Option 1: Same cell.**

**- Option 2: Cells belonging to the same gNB.**

**- Option 3: Cells belonging to the same RNA.**

**- Option 4: Configurable between Option 1 and option 3 (i.e. network can configure: No ROHC, ROHC in same cell, ROHC in same RNA)**

**Q2: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 4 | We think network configuration between RNA level ROHC and cell level ROHC as in option 4 above provides all the necessary flexibility. We are also okay with option 3 on its own. Option 1 on its own looks too restrictive and option 2 is probably unnecessary (Other options will require more signalling and configuration which is not really necessary in our view).  |
| Samsung | Option 3 | Open to consider option 4, if that’s the majority view |
| Sharp | Option 1 |  |
| OPPO | Option 1 | For Option 3, if the ROHC protocols used by anchor gNB and target gNB are different, anchor w/o relocation shall be performed. Additional Xn signalling is needed to check this, which would involve RAN3. |

## 2.3 LCH Restrictions

The related proposals in the submitted documents are captured below.

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| --- |
| [2] Proposal 2: LCH restriction "allowedServingCells" is not applied during the SDT procedure.[4] Proposal 5. RAN2 agrees on the RAN2#115e Working Assumption that “LCH restrictions can be applied, re-using existing signalling. It is up to gNB how restrictions are configured and MAC applies current specification rules”.[5] Proposal 1: RAN2 confirms the working assumption on the support of LCP restriction for SDT procedure.[7] Proposal 1: Confirm the LCH restriction is applicable during the SDT procedure.[7] Proposal 2: NW can provide the SDT specific LCH restriction in the SDT configuration of the RRCRelease message.[9] Proposal 3: RAN2 confirm that LCH restrictions can be applied for SDT.[9] Proposal 4: It is up to network implementation to ensure no restriction for the use of CG resource for the LCH channels corresponding to SDT RBs (all CG resources for SDT are allowed for each LCH supporting SDT).[10] Proposal 2: LCH mapping restriction configuration/behaviour is different for UL transmissions in RRC\_CONNECTED and SDT in RRC\_INACTIVE, e.g. UE may not apply LCH mapping restrictions in RRC\_INACTIVE for SDT. Details are FFS.[15] Proposal 3: SDT DRBs that cannot be multiplexed on SDT resources available in the current SDT procedure due to LCH restrictions should be considered as non-SDT DRBs for the duration of the SDT procedure.[16] Proposal 4: Confirm working assumption: LCP LCH selection restrictions configured in LCP in connected mode are kept and reused for SDT in Inactive state.[18] Proposal 2: LCH restriction information can be configured by RRC with RRCRelease message.[18] Proposal 3: LCH restriction can be applied in CG-SDT only.[19] Proposal 3: Make the working assumption for LCH restriction as an agreement.[19] Proposal 4: For a DRB, whether to allow SDT is configured. Separate restriction for RA-SDT and CG-SDT is not supported. |

In RAN2#115e meeting, it is agreed as a working assumption that LCH restrictions can be applied, re-using existing signalling, and it is up to gNB how restrictions are configured and MAC applies current specification rules. It is also agreed that RAN2 may revisit this issue in this meeting if any technical issues found. Thus, it should be decided first whether the working assumption in the last meeting can be confirmed.

**Issue 3: Can we confirm the working assumption (i.e. LCH restrictions can be applied, re-using existing signalling, and it is up to gNB how restrictions are configured and MAC applies current specification rules)?**

**- Option 1: Yes.**

**- Option 2: No, LCH restriction is not applied for SDT.**

**Q3: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 | Regarding option 1, we really don’t think LCH restrictions are needed since they duplicate the SDT and non-SDT data configuration (i.e. any LCH not suitable for SDT shall not be configured for SDT). All SDT data should be feasible to be sent during SDT session. Otherwise, we create unnecessary dependencies between CG and RA selection. Even if we go for option 1 we think there should be no further optimisation for scenarios where SDT is initiated but LCH restrictions prevent SDT. In other words, it is up to the network to ensure LCH restrictions will allow both CG and/or RA and will not result in any further checks or restrictions in MAC.  |
| Samsung | Option 2 | Given that network indicates which RBs are used for SDT, we do not see any need for further LCH restrictions during SDT. |
| Sharp | Option 2 | Considering RAN2 will focus on initial BWP for RA and CG SDT, it is not necessary to discuss applying the LCH restriction. |
| OPPO | Option 2 | We also do not see the necessity to apply LCH restriction. Suggest to make the procedure simple. |

If LCH restriction is agreed for SDT, the follow-up question is whether it is applied only for CG-SDT or both for CG-SDT and RA-SDT. Though the rapporteur think it should be applied for only CG-SDT, it is good to check companies’ views and make firm agreement.

**Issue 4: If LCH restriction is applied for SDT, is it applied only for CG-SDT or both for CG-SDT and RA-SDT?**

**- Option 1: LCH restriction is applied only for CG-SDT.**

**- Option 2: LCH restriction is applied for both CG-SDT and RA-SDT.**

**Q4: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 (if LCH options are agreed) | But the assumption is that the LCH restrictions if applied would not result in any further restrictions within MAC (i.e. left to network implementation).  |
| Samsung | Option 2 |  |
| OPPO | Option 2 |  |

## 2.4 PHR

The related proposals in the submitted documents are captured below.

|  |
| --- |
| [2] Proposal 3: So RAN2 should discuss and agree one of the following optionsOption 1: SDT data is prioritized over PHR MAC CE.Option 2: Revert/cancel the agreement “ During the SDT procedure, all the triggered PHRs are cancelled if all SDT data are included in the UL grant, if there is NO room in the MAC PDU to fit the PHR”[3] Proposal 5 A Data volume threshold is defined to trigger PHR[3] Proposal 6 PHR is triggered by initiation of the PHR procedure[4] Proposal 2. The stored configuration of PHR in the UE AS Context is used during an SDT procedure.[8] Proposal 5: Dedicated PHR configuration can be provided to the UE in RRCRelease message for both CG-SDT and RA-SDT. [8] Proposal 6: Dedicated PHR configuration for SDT can be utilized in the cell where the UE has received the RRCRelease message while in case the UE has no dedicated configuration or reselects another cell, it would use the default configuration for both CG-SDT and RA-SDT.[12] Proposal 3: The PHR should be configurable for SDT, and it is up to NW to determine whether PHR is needed or not in SDT.[12] Proposal 4: Separate SDT PHR configuration should be included in SIB. If the SDT PHR configuration is not broadcasted, then the default configuration will be used[16] Proposal 3: The default MAC configuration is used for determining the PHR parameters in INACTIVE.[19] Proposal 1: BSR configuration and PHR configuration used for SDT could be signalled by Gnb in RRCRelease message. |

RAN2 made some progresses for PHR issue in the last meeting, and made following agreements.

- Legacy PHR triggers are applied for SDT.

- The LCP priority of PHR MAC CE in SDT is same as in RRC\_CONNECTED, i.e. the PHR MAC CE in SDT is prioritized over SDT data

- During the SDT procedure, all the triggered PHRs are cancelled if all SDT data are included in the UL grant, if there is NO room in the MAC PDU to fit the PHR.

However, Samsung [2] think that the second and third agreements are contradictory with following reasons. According to 2, LCP priority for PHR is same as in legacy i.e. PHR has higher priority than DTCH. So PHR will be included in UL grant before the SDT data. However, according to 3, it is assumed that SDT data is first included in UL grant and after including all the SDT data if there is no room in UL grant, PHR is not included and PHR is cancelled.

**Issue 5: Do you think the previous agreements on PHR are contradictory?**

**- Option 1: Yes, the UL data should be prioritized over PHR MAC CE in LCP procedure.**

**- Option 2: No, previous agreements are fine.**

**Q5: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 |  |
| Samsung | Option 1 or remove the agreement “ During the SDT procedure, all the triggered PHRs are cancelled if all SDT data are included in the UL grant, if there is NO room in the MAC PDU to fit the PHR” | Previous agreements1. The LCP priority of PHR MAC CE in SDT is same as in RRC\_CONNECTED, i.e. the PHR MAC CE in SDT is prioritized over SDT data
2. During the SDT procedure, all the triggered PHRs are cancelled if all SDT data are included in the UL grant, if there is NO room in the MAC PDU to fit the PHR.

As per agreement 1, PHR will be first included in MAC PDU and PHR is cancelled as per section 5.4.6 of TS 38.321“1. if the allocated UL resources can accommodate the MAC CE for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of LCP as defined in clause 5.4.3.1:

:: 2> cancel all triggered PHR(s).“So there is no case where the second agreement applies. |
| Sharp | Option 2 |  |
| OPPO | Option 2 |  |

Regarding PHR triggers, Ericsson [3] propose to discuss two issues. First one is to introduce a data volume threshold to decide inclusion of PHR MAC CE, and the second one is to introduce a new PHR trigger at initiation of SDT procedure. Companies are asked to provide their views on the two issues.

**Issue 6: Do you think a data volume threshold is needed to decide inclusion of PHR MAC CE?**

**- Option 1: Yes, the PHR is included if the data volume is above the threshold.**

**- Option 2: No.**

**Q6: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 | We don’t really think an additional threshold is really justified for this!  |
| Samsung | Option 2 |  |
| Sharp | Option 2 |  |
| OPPO | Option 2 |  |

**Issue 7: Do you think a PHR should be triggered at initiation of SDT procedure?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q7: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | No new trigger shall be defined (i.e. Option 1) | We think legacy rules should be followed. Per the legacy rules, the PHR will be triggered “upon configuration or reconfiguration of the power headroom reporting functionality by upper layers, which is not used to disable the function”.If we have PHR in either RRCRelease or SIB, the RRC layer will configure PHR in case SDT is initiated, and PHR will be triggered. No extra condition is needed. |
| Samsung | No new trigger is needed | Same view as ZTE |
| Sharp | Option 1 |  |
| OPPO | Option 1 | Agree with ZTE. |

The remaining issue is on PHR configuration. Basically, there are four options, i.e. dedicated configuration (via RRCRelease message), common configuration (via SIB), default configuration (via default MAC Cell Group configuration), and stored configuration (via stored UE AS context). Companies are asked to provide their views on this issue.

**Issue 8: How the PHR is configured?**

**- Option 1: Dedicated configuration via RRCRelease message.**

**- Option 2: Common configuration via SIB.**

**- Option 3: Default configuration via default MAC Cell Group configuration.**

**- Option 4: Stored configuration via stored UE AS context.**

**Q8: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 | We think SDT specific PHR configuration should be included in SIBOption 1 doesn’t work for different cell case (unless all cells have same configuration, which is a bit odd restriction on the network).  |
| Samsung | Option 3 | In our view default configuration is sufficient |
| Sharp | Option 3 |  |
| OPPO | Option 3 |  |

If option 1 or option 2 is chosen in Issue 8, the follow-up question is what if the PHR configuration is not provided by RRCRelease or SIB. Huawei [8] and ZTE [12] propose to use default configuration in this case, but this should be checked with other companies.

**Issue 9: If PHR configuration is not provided by RRCRelease or SIB, what is the UE behaviour?**

**- Option 1: PHR is not used.**

**- Option 2: Configure PHR according to default MAC Cell Group configuration.**

**- Option 3: Do not need to consider this case. PHR configuration is always provided.**

**Q9: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 | Option 2 becomes automatic if nothing else is configured.  |
| Samsung | As in Q8 | In our view default configuration is sufficient |
| Sharp | Option 2 |  |

## 2.5 BSR

The related proposals in the submitted documents are captured below.

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| --- |
| [3] Proposal 2 The BSR parameters for SDT periodicBSR-Timer and retxBSR-Timer should be configurable via RRCRelease or SI.[3] Proposal 3 If the BSR parameters for SDT are not configured in either RRCRelease or SI, the parameter values from the default MAC Cell Group configuration are used[3] Proposal 4 RAN2 should discuss if a short BSR format should be supported.[4] Proposal 1. The default/common configuration of BSR is used during an SDT procedure.[5] Proposal 1 BSR configuration in default MAC cell group configuration is used if delaying the SR transmission is not supported in SDT, otherwise, UE-specific BSR configuration provided by Gnb is used.[8] Proposal 7: Dedicated BSR configuration can be provided to the UE in RRCRelease message for both RA-SDT and CG-SDT. [8] Proposal 8: Dedicated BSR configuration for SDT can be utilized in the cell where the UE has received the RRCRelease message while in case the UE has no dedicated configuration or reselects another cell, it would use the default configuration for both RA-SDT and CG-SDT.[9] Proposal 1：During SDT, the BSR configuration in the default MAC cell group configuration is applied.[9] Proposal 2: During SDT, the BSR calculation does not take suspended RBs into consideration.[12] Proposal 1: The configuration of logicalChannelSR-DelayTimer should be allowed for SDT, and the UE specific logicalChannelSR-DelayTimerApplied stored for each logical channel will be used in SDT.[12] Proposal 2: SDT specific BSR configuration should be introduced in SIB. If the SDT specific BSR configuration is broadcasted, then the broadcasted configuration will be used. Otherwise, the default configuration should be used.[14] Proposal 10: UE applies the BSR configuration in the default MAC cell group configuration.[15] Proposal 1: Default BSR configuration for SDT is specified where SRBs and DRBs belong to different LCG.[16] Proposal 1: A new BSR is triggered using the existing BSR triggers upon new data arrival for SDT DRBs. [16] Proposal 2: RRC release message can provide separate BSR MAC configuration for determining the BSR parameters in INACTIVE state.[18] Proposal 1: BSR for SDT is configured by Gnb with RRCRelease message.[19] Proposal 1: BSR configuration and PHR configuration used for SDT could be signalled by Gnb in RRCRelease message. |

Regarding BSR, the following agreements were made in RAN2#115e meeting.

- The BSR configuration used for SDT can be different from the BSR configuration used in RRC\_CONNECTED.

- [CB] FFS Whether the BSR configuration used for SDT is configured by Gnb or used from default configuration needs further discussion. (Gnb 10 / default 11)

Similar to PHR, how the BSR is configured is major issue that needs to be resolved in this meeting. Looking through the documents, three options are on the table, i.e. dedicated configuration (via RRCRelease message), common configuration (via SIB), and default configuration (via default MAC Cell Group configuration).

**Issue 10: How the BSR is configured?**

**- Option 1: Dedicated configuration via RRCRelease message.**

**- Option 2: Common configuration via SIB.**

**- Option 3: Default configuration via default MAC Cell Group configuration.**

**Q10: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 |  |
| Samsung | Option 3 | In our view default configuration is sufficient. No need of further optimising as SDT is for short duration and involves only few transmissions. |
| Sharp | Option 1,3 |  |
| OPPO | Option 3 |  |

If option 1 or option 2 is chosen in Issue 10, the follow-up question is what if the BSR configuration is not provided by RRCRelease or SIB.

**Issue 11: If BSR configuration is not provided by RRCRelease or SIB, what is the UE behaviour?**

**- Option 1: BSR is not used.**

**- Option 2: Configure BSR according to default MAC Cell Group configuration.**

**- Option 3: Do not need to consider this case. BSR configuration is always provided.**

**Q11: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 | Option 2 becomes automatic if nothing else is configured.  |
| Samsung | Option 2 | In our view default configuration is sufficient. No need of further optimising as SDT is for short duration and involves only few transmissions. |
| Sharp | Option 2 |  |

In the BSR-Config, three timers are included, i.e. periodicBSR-Timer, retxBSR-Timer, and logicalChannelSR-DelayTimer. It is questioned whether the logicalChannelSR-DelayTimer is applied for SDT. Note that the logicalChannelSR-DelayTimer is not included in the default MAC Cell Group configuration.

**Issue 12: Can the logicalChannelSR-DelayTimer be applied for logical channels configured with SDT?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q12: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 |  |
| Samsung | Option 2 | Not essential |
| Sharp | Option 2 | It is better to report the data volume as soon as possible within SDT procedure instead of delaying report. |
| OPPO | Option 2 |  |

One optimization is proposed by Ericsson [3] such that additional short formats could be introduced by e.g. removing the MAC subheader for the short BSR and using the R-bit in i.e. the R/F/LCID MAC subheader of the MAC SDU to signal inclusion of a short BSR. Companies are asked to provide their views on the need of BSR format enhancements for SDT.

**Issue 13: Is it worth to consider BSR format enhancements for SDT?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q13: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 |  |
| Samsung | Option 2 |  |
| Sharp | Option 2 |  |
| OPPO | Option 2 |  |

Another issue is raised by NEC [9] whether the BSR calculation takes suspended RBs into consideration during SDT. There may be buffered PDCP and/or RLC packets for the suspended RBs (which are corresponding to non-SDT radio bearers), because the buffered UL data may not be able to be transmitted upon reception of RRCRelease message. If the suspended radio bearers are taken into consideration for BSR, and there are non-SDT RB and SDT RB belonging to the same LCG, it will be hard for the network to make decision on whether to resume RRC Connection or not. Thus, it is proposed in [9] that the BSR calculation does not take suspended RBs into consideration during SDT. But it should be noted that in RAN2#115e meeting, RAN2 confirms that the suspended RBs shall be considered for BSR calculation, and no change is required to the specifications.

**Issue 14: Should the BSR calculation take suspended RBs into consideration during SDT?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q14: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1(based on existing specs) | Same procedure as BSR should be reused as agreed.  |
| Samsung | Option 1 | Follow legacy procedure |
| Sharp | Option 1 |  |
| OPPO | Option 1 | But we are wondering whether it is a valid case that there is still data buffered in UE when RRCRelease is received as raised by [9] |

## 2.6 Data volume calculation

The related proposals in the submitted documents are captured below.

|  |
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| [9] Proposal 5: RAN2 discuss if we need to address the issues of data volume calculation for SDT: If the new UL data from upper layer are considered as PDCP SDU for data volume calculation If the buffered data in PDCP entity and RLC entity which are to be discarded upon SDT initialization are take into account for data volume calculation[10] Proposal 4: RAN2 to clarify whether the data volume is calculated by the MAC layer before the RBs configured for SDT are resumed.[11] Proposal 1: Data volume checking for SDT/non-SDT is modelled in RRC.[13] Proposal 1: The PDCP header is not considered for the data volume computation.[13] Proposal 2: The data volume used for SDT selection criteria includes the RRCResumeRequest message.[16] Proposal 6: CCCH bits are not included in the data volume computation for SDT resource selection. |

It is agreed in RAN2#115e meeting that the Data volume used for SDT selection criteria is calculated as the total sum of Buffer Size across SDT RBs (i.e. same approach as BSR). But, there are still unclear points that need to be resolved.

In the current RRC/MAC running CRs, it is modelled that the data volume checking is done in MAC before resuming SDT RBs in RRC. It means that the MAC has visibility of upper layer data before the SDT RBs are resumed. This is possible if upper layer data arrives at PDCP layer of SDT RB even if the SDT RB is suspended. However, it has to be discussed whether the upper layer data can arrive at PDCP layer of suspended RB. Companies are asked to provide their views on this issue.

**Issue 15: Do you think the NAS data can arrive at PDCP layer of suspended RBs?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q15: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Yes  | This issue has already been discussed and we agreed that this modelling is the baseline. Similar to EDT, we have to assume this behaviour and current running CRs are based on this. We don’t think we should rediscuss this framework unless there is something that precludes this according to the existing specs.  |
| Samsung | Yes | Same view as ZTE |
| Sharp | Option 1 Yes |  |
| OPPO | Not sure | We have not a spec to capture this. No matter whether companies think NAS data can arrive at AS, it maybe up to UE implementation to calculate the data volume. |

If it is agreed that NAS data can arrive at PDCP layer of suspended RBs, the implementation should be cautious that the NAS data is just stored in the PDCP SDU buffer without further processing. This is because if the NAS data is processed into PDCP PDU or RLC SDU/PDU, they will be discarded at SDT procedure initiation due to PDCP/RLC re-establishment.

**Issue 16: If NAS data can arrive at PDCP layer of suspended RBs, do you agree that the NAS data should be just stored in PDCP SDU buffer without further processing?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q16: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 | But no specification work is needed for this. The details can be left to UE implementation (similar to how it was done for EDT). |
| Samsung | Option 1 | Same view as ZTE |
| Sharp | Option 1 |  |
| OPPO | Option 1 |  |

If it is agreed that the NAS data is just stored in PDCP SDU buffer without further processing, there would be no constructed PDCP PDU, and thus PDCP header is not considered in SDT data volume calculation. This issue is raised by Xiaomi [13].

**Issue 17: If NAS data can arrive at PDCP layer of suspended RBs, do you agree that PDCP header is not considered for the SDT data volume calculation?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q17: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 (same as BSR) | No optimisation is needed (i.e. we can reuse BSR like mechanism). Similar approach is also used for EDT. So, we don’t see much difference here. |
| Samsung | Option 1 | Same view as ZTE |
| Sharp | Option 1 |  |
| OPPO | Option 1 |  |

On the other hand, if it is agreed that NAS data cannot arrive at PDCP layer of suspended RBs, the SDT data volume calculation in MAC should be done by UE implementation. That is, the MAC should check the upper layer data volume via UE internal coordination. The calculated SDT data volume is the virtual PDCP SDU size of NAS data.

**Issue 18: If NAS data cannot arrive at PDCP layer of suspended RBs, do you agree that the MAC calculates the NAS data volume by UE internal coordination?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q18: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Not needed | The AS has to have visibility of upper layer data we think the details need not be discussed on how this is visible (similar to how it has been specified for EDT).  |
| Samsung | Not needed | Same view as ZTE |
| Sharp | Option 1 | It could be UE implementation. |
| OPPO | Option 1 | Up to UE implementation. No internal coordination needs to be defined. |

If it is agreed that the MAC calculates the NAS data volume by UE internal coordination, the MAC can reflect the NAS data into the SDT data volume calculation (as a virtual PDCP SDU) in principle. Thus, NEC [9] raise a question whether the upper layer data is regarded as PDCP SDU for SDT data volume calculation.

**Issue 19: If the MAC calculates the NAS data volume by UE internal coordination, do you think the NAS data should be regarded as PDCP SDU?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q19: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Same as above | We again think the BSR mechanism can be reused. So, it is not clear what is missing (e.g. from section 5.6 of PDCP spec).  |
| Samsung | Same view as ZTE |  |
| Sharp | Option 1 |  |
| OPPO | - | Either PDCP PDU or MAC PDU is fine for us. |

NEC [9] raise another issue of whether the buffered data in PDCP/RLC entities are considered in SDT data volume calculation. The PDCP re-establishment and RLC re-establishment are not performed when SDT data volume calculation is performed, and there may be buffered packets at PDCP and/or RLC entities, which will be discarded upon SDT initialization due to PDCP/RLC re-establishment. If they are counted in SDT data volume calculation, SDT criteria may not be met.

**Issue 20: Do you think that the buffered packets in PDCP/RLC entities should be counted in SDT data volume calculation?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q20: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 | Again, same as BSR. But in this case, there will be no packets in RLC anyway.  |
| Samsung | Option 1 | Same view as ZTE |
| Sharp | Option 1 |  |
| OPPO | Option 1 | we are not sure the case is valid. |

The last issue is whether the CCCH message (i.e. RRCResumeRequest) is considered in SDT data volume calculation. This issue is remained as FFS in current MAC running CR. On one hand, it is thought that CCCH message cannot be considered in SDT data volume calculation because RRCResumeRequest message is constructed only after SDT data volume check is performed (InterDigital [16]). On the other hand, if it is agreed that NAS data volume can be calculated by UE internal coordination, it is also thought possible to consider CCCH message into SDT data volume calculation (Xiaomi [13]). Companies are asked to provide their views on this issue.

**Issue 21: Do you think the size of CCCH message should be considered in SDT data volume calculation?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q21: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 2 | The CCCH message size is constant. If we reuse the BSR mechanism then CCCH size is not included. However, since the CCCH size is constant and known to the network, it can take it into account when configuring the data volume threshold. So, there is no need for the UE to add this in the calculation then (i.e. network can implicitly include this in the threshold).  |
| Samsung | Option 2 |  |
| Sharp | Option 2 |  |
| OPPO | Option 1 | No strong view. If it can not be confirmed that NAS data can arrive at AS, we think it is acceptable to take all the data into account since the data volume check is more likely based on estimation. |

## 2.7 TAT

The related proposals in the submitted documents are captured below.

|  |
| --- |
| [2] Proposal 4: timeAlignmentTimer as in leagcy is used for RA-SDT.[3] Proposal 7 The legacy TAT is reused for RA-SDT[3] Proposal 8 A separate CG-SDT TAT is used for CG-SDT[4] Proposal 3. Normal (i.e. legacy) TAT is applicable to both CG-SDT and RA-SDT.[4] Proposal 4. Upon expiry of the normal (or legacy) TAT during an SDT procedure, UE behaves similarly as in RRC\_CONNECTED, i.e. UE suspends all UL transmissions and triggers RACH if any UL transmission is still needed.[5] Proposal 2: SDT-TAT would be also applied to RA-SDT.[7] Proposal 5: The cell specific TAT configuration in the SIB1 of the current camping cell is used for the RA-SDT procedure.[12] Proposal 6: For CG-SDT, TAT-SDT will be used for both CG resource validity verification and TA maintenance during CG-SDT subsequent data transmission[12] Proposal 7: TAT-SDT is used in both RA-SDT and CG-SDT, and TAT-SDT will be used for CG resource verification and TA maintenance in subsequent SDT transmission.[12] Proposal 8: Once the RRC resume message is received during SDT, the UE should start normal TAT and stop TAT-SDT. FFS whether an initial value is needed for the normal TAT timer, taking the value of TAT-SDT into account (e.g. set the initial value of TAT to current value of TAT-SDT).[14] Proposal 4: RAN2 should discuss which TAT timer, i.e., either TAT-SDT timer or normal TAT timer, is used in RA-SDT and the normal RACH switched from CG-SDT.[14] Proposal 5: TAT-SDT timer is used for the whole CG-SDT session including the first UL transmission and subsequent data phase, unless UE switch to normal RACH procedure.[14] Proposal 6: UE maintains only one NTA value during the SDT session no matter in which SDT phase. The value of NTA can be updated by the reception of TA command (as legacy), then the TA timer will be re-started.[14] Proposal 7: UE should use normal TA timer for RA-SDT.[14] Proposal 8: After UE switch to normal RACH from CG-SDT, UE applies TA command and update NTA value after contention resolution is considered successful. The normal TA timer (re)starts and TAT-SDT timer stops if running.[14] Proposal 9: When UE receives the RRC resume message in SDT, TAT-SDT timer stops, and normal TA timer starts. The existing NTA value is applied unless UE receives the new TA command.[17] Proposal 1. Legacy TAT starts/restarts when RAR TAC and TAC MAC CE is received in RA-SDT and CG-SDT, as in legacy NR.[17] Proposal 2. CG-SDT-TAT starts when CG-SDT is configured via RRCRelease and restarts upon the reception of TAC MAC CE in the subsequent transmission of CG-SDT.[17] Proposal 3. Both CG-SDT-TAT value and TA value are provided when CG-SDT is configured via RRCRelease message.[20] Proposal 5: The TAC in Msg2/MsgB of the RACH procedure does not restart the CG-SDT TAT. |

Regarding TAT issue, RAN2 already made agreements as followings:

- A new TA timer for TA maintenance specified for configured grant based small data transfer in RRC\_INACTIVE should be introduced. The TA timer is configured together with the CG configuration in the RRCRelease message.

- This new timer i.e. TAT-SDT is started upon receiving the TAT-SDT configuration from gNB, i.e. RRCrelease message, and can be (re)started upon reception of TA command

From the agreement, it is clear that TAT-SDT is used for UL timing maintenance during CG-SDT procedure. And it is of no question that the legacy TAT (i.e. timeAlignmentTimerCommon in SIB) is used for UL timing maintenance during legacy RA procedure.

The issue is which TAT should be used for UL timing maintenance during RA-SDT procedure.

**Issue 22: Which TAT should be used for UL timing maintenance during RA-SDT procedure?**

**- Option 1: Legacy TAT (i.e. timeAlignmentTimerCommon in SIB).**

**- Option 2: TAT-SDT.**

**- Option 3: Any of legacy TAT or TAT-SDT.**

**Q22: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | We think single TAT could be simpler (i.e. option 2), but Option 3 is also okay | Basically, it seems legacy TAT is used for TA maintenance whilst TAT-SDT is used for TA maintenance as well as maintenance of CG-resource. The main question is whether the initial value of these two timers will be the same or not. If the initial value can be assumed to be the same, then we think we can reuse single timer and simplify the framework. If not then we can maintain both timers for different purposes.  |
| Samsung | Option 1 | Same timer and handling as in legacy RA procedure |
| Sharp | Option 1 |  |
| OPPO | Option 1 |  |

Regarding TAT behaviour, it seems that all companies agree that legacy TAT starts/restarts when RAR TAC or TAC MAC CE is received, regardless of SDT procedure. It is good to confirm this assumption.

**Issue 23: Do you agree that the legacy TAT (i.e. timeAlignmentTimerCommon in SIB1) starts/restarts when RAR TAC or TAC MAC CE is received, regardless of SDT procedure, i.e. no change to the current ehaviour?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q23: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 |  |
| Samsung | Option 1 |  |
| Sharp | Option 1 |  |
| OPPO | Option 1 |  |

For the TAT-SDT, it is agreed that the TAT-SDT starts upon reception of CG-SDT configuration in the RRCRelease message, and restarts upon reception of TAC. The rapporteur think that the TAT-SDT restart upon TAC reception is only for CG-SDT procedure, and it is not clear whether the TAT-SDT starts/restarts when RAR TAC (i.e. Msg2 or MsgB) or TAC MAC CE is received during legacy RA procedure and RA-SDT procedure. It is good to clarify this point.

**Issue 24: Does the TAT-SDT start/restart when RAR TAC is received during legacy RA procedure?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q24: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 | We think TAT-SDT can be restarted since it is used for CG configuration maintenance which is somehow implicitly related to TA. We already agreed this, right??.RAN2#113e: “TAT-SDT is started upon receiving the TAT-SDT configuration from Gnb, i.e. RRCrelease message, and can be (re)started upon reception of TA command.” |
| Samsung | See comments | TAT-SDT start/restart upon completion of RA procedure. It is not started/restarted upon reception of RAR TAC. Note that it is possible that after RAR reception, RA procedure is not completed |
| Sharp | Option 1 for restart | TAT-SDT could be restarted if it is running. However, we think TAT-SDT could only be started when RRC release is received |
| OPPO | See comments | Depends on whether RA is completed successfully. But we are not sure whether the CG-SDT resources are released when RACH/RA-SDT is triggered. |

**Issue 25: Does the TAT-SDT start/restart when RAR TAC is received during RA-SDT procedure?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q25: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 | Per the current agreement…  |
| Samsung | See comments | TAT-SDT start/restart upon completion of RA procedure. It is not started/restarted upon reception of RAR TAC. Note that it is possible that after RAR reception, RA procedure is not completed |
| Sharp | Option 1 for restart | Same comments as Q24 |
| OPPO | See comments | Same view as Q24 |

**Issue 26: Does the TAT-SDT start/restart when TAC MAC CE is received during subsequent RA-SDT procedure?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q26: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 |  |
| Samsung | Option 1 |  |
| Sharp | Option 1 for restart | Same comments as Q24 |
| OPPO | See comments | Further discussion may be needed on whether CG-SDT resources are kept when RA-SDT is triggered. |

Last issue is whether the CG-SDT resource should be released at the expiry of legacy TAT, raised by Intel [4]. However, it is not clear when this case can happen, because the legacy TAT, even if it is started during SDT procedure upon reception of RAR TAC or TAC MAC CE, would be considered as expired at the end of the SDT procedure (i.e. MAC is reset upon reception of RRCRelease message). Thus, the rapporteur want to check whether this is realistic scenario that the legacy TAT expires while the UE is in RRC\_INACTIVE.

**Issue 27: Do you think the legacy TAT can expire while the UE is in RRC\_INACTIVE?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q27: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 |  |
| Samsung | Option 1 |  |
| Sharp | Option 2 |  |
| OPPO | Option 1 |  |

If it is agreed that the legacy TAT can expire in RRC\_INACTIVE, it should be discussed whether the CG-SDT resource should be released at the expiry of legacy TAT.

**Issue 28: If the legacy TAT can expire while the UE is in RRC\_INACTIVE, should the CG-SDT resource be released at the expiry of legacy TAT?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q28: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE  | Option 2 | We should stick to current behaviour. i.e. as below: 1. when a *timeAlignmentTimer* expires:
2. clear any configured downlink assignments and configured uplink grants;

This means that the resource will be cleared in MAC, but the RRC configuration will not be released. The CG configuration will only be released when the CG-SDT timer expires (assuming we will have two separate timers for this).  |
| Samsung | Option 2 | CG-SDT resources are released when TAT-SDT expires, |
| Sharp | Option 2 |  |
| OPPO | Option 2 |  |

## 2.8 Token bucket

The related proposals in the submitted documents are captured below.

|  |
| --- |
| [10] Proposal 3: RAN2 to discuss the handling of token bucket for SDT in RRC\_INACTIVE. |

Lenovo [10] ask whether the token bucket is used for SDT. The token bucket mechanism is used in RRC\_CONNECTED in order to avoid the starvation of low priority LCHs. However, there may be no starvation issue for uplink transmissions in RRC\_INACTIVE, and this mechanism is not needed for SDT. Companies are asked to provide their views on this issue.

**Issue 29: Is the token bucket mechanism applied for SDT?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q29: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Yes | No change is needed to support this in MAC. The logical channel configuration stored in the UE context will be reused for this anyway.  |
| Samsung | Yes |  |
| Sharp | Option 1 |  |
| OPPO | Option 2 |  |

## 2.9 PUSCH skipping

The related proposals in the submitted documents are captured below.

|  |
| --- |
| [1] Proposal 2: The Rel-16 PUSCH skipping feature is supported for CG-SDT. |

Given that the realistic traffic pattern is difficult to precisely predict, the UE may not have any available uplink data at beginning of the transmission occasion of CG PUSCH. Thus, vivo [1] propose to support PUSCH skipping for CG-SDT.

**Issue 30: Is the PUSCH skipping mechanism supported for CG-SDT?**

**- Option 1: Yes.**

**- Option 2: No.**

**Q30: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 1 | No change is needed to support this in MAC. The logical channel configuration stored in the UE context will be reused for this anyway. |
| Samsung | Option 1 |  |
| Sharp | Option 1 |  |
| OPPO | Option 1 |  |

## 2.10 TA validation

RAN1 has further discussed the remaining issues on the SSB subset determination for RSRP based TA validation, but still companies cannot reach consensus to select one from the following options. Thus, RAN1 ask RAN2 to down-select a solution below [21]. RAN1 kindly asks if the down-selection can be done in RAN2. Note that in RAN1#105-e meeting RAN1 has agreed that the SSB subset for RSRP based TA validation is determined at least based on a configured absolute RSRP threshold.

|  |
| --- |
| The SSB subset for RSRP based TA validation is determined as* Option 1: Within a set of SSBs configured per CG configuration
* Option 2: Within a set of SSBs configured for all CG configurations
* Option 3: Within a set of all SSBs actually transmitted as indicated in SIB1
* Option 4: Highest N SSBs of all SSBs actually transmitted as indicated in SIB1
 |

**Issue 31: Which SSB subset should be used for RSRP based TA validation?**

**- Option 1: Within a set of SSBs configured per CG configuration.**

**- Option 2: Within a set of SSBs configured for all CG configurations.**

**- Option 3: Within a set of all SSBs actually transmitted as indicated in SIB1.**

**- Option 4: Highest N SSBs of all SSBs actually transmitted as indicated in SIB1.**

**Q31: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Detailed Comments |
| ZTE | Option 4 | We have no strong view on this, but we think the important thing to ensure is that there is only one TA maintained per cell. So, the actual criterion should be per cell (not per CG configuration). So, it is not clear what option 1 exactly means. Option 2 could work, but we are not sure if the actual TA of the cell is based on the SSBs on which CG resource is configured. So, we think options 3 and 4 are independent of the CG configuration and may be one of them is sufficient. Option 4 is similar to cell selection criterion. So, we thought this could be simply reused.  |
| Samsung | Option 3/4 | TA is per cell and not per CG configuration. So either option 3 or option 4 is sufficient. |
| Sharp | Option 4 | Share the same view with ZTE. |
| OPPO | Option 4 | In our understanding, whether TA is valid depends on the location of UE, regardless of whether CG resources are configured. We are fine with Option4 which is similar as the criteria of cell reselection.  |

# 3. Conclusions

To be filled later..

# 4 Contact Information

|  |  |
| --- | --- |
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[2] R2-2109524 User Plane Common Aspects of RACH and CG based SDT Samsung

[3] R2-2109593 Common aspects for SDT Ericsson

[4] R2-2109621 User plane leftover issues for SDT procedure Intel

[5] R2-2109711 Remaining UP open issues Fujitsu

[6] R2-2109768 Discussion on user plane issues of SDT OPPO

[7] R2-2110030 User plane aspects of SDT Apple

[8] R2-2110182 User plane common aspects for SDT Huawei, HiSilicon

[9] R2-2110255 Remaining user plane aspects of SDT NEC

[10] R2-2110328 The UP common issues for small data transmissions Lenovo, Motorola Mobility

[11] R2-2110397 Consideration on UP remaining issues of SDT? CATT

[12] R2-2110575 User plane common aspects for SDT ZTE Corporation, Sanechips

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[16] R2-2110915 User plane aspects of small data transmission InterDigital

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[19] R2-2111124 Remaining UP issues in SDT LG Electronics Inc.

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